element 6a. The tube, through the positioning of the nozzle, engages the cooling box 15 of a mold 10a. This cooling box 15 is provided with a rectangular spiral 16 surrounded by a tight box 17, so that a continuous canal is formed to pass cooling water. The enlarged tube 5a is supplied with a thread at its free end so that a stem 18 of a pouring closure can be attached. When the nozzle 1a engages the cooling box 15, the tube 5a with its heating element 6a and the attached stem 18 are moved through the cooling box 15 as well as through the walls of the pouring canal of the mold 10a. Prior to conducting the load, the apparatus appears in the position shown in FIG. 2. In order to carry out the load, the nozzle needle is retracted, but the little tube 5a with the mounted stem 18 remains in the same position, although it is also possible to retract the tube 5a along with the hollow nozzle needle 3a which surrounds it. In this manner the nozzle 1a and the pouring closure 19 are opened and the load can be introduced into the mold cavity 20. Again, as has already been explained, the cooling box will cool the outer zone of the stream which enters the cavity from the nozzle, while its inner zone is heated around the tube 5a by means of the heating element 6a. Because of the good contact between the free end of the tube 5a and the stem 18, there is contribution by the latter to the heat exchange, even when the stem is thermally inert. After the expulsion of the load, the nozzle needle 3a will be positioned with its frontal surface 8a against the nozzle opening 9a and closes the nozzle. The tube 5a likewise slides forward and the stem 18 (which is mounted on its frontal face) closes the pouring closure 19 in such a way that its frontal face is united with the receiving part of the walls of the cavity, so that by cooling, a form free of a mold mark is formed. After sufficient cooling, the tube 5a is retracted in the nozzle needle and the nozzle is removed from its place on the cooling box 15.

In this case also, the invention is not limited to the example described. For example, the tube 5a can be solidly attached to the nozzle if, by use of fine manufacturing tolerances, the frontal surface of the stem is set accurately flush with the walls of the cavity at the position where the mouthpiece 2a and nozzle opening 9a are set in place. The assemblies necessary for a common drive can be simplified if the sliding movement of the tube 5a inside the nozzle needle, is limited and is preloaded by means of a spring toward the closing direction. By retracting the nozzle needle (at least in a second part of the stroke travel) the pouring closure 19 will be opened. By sliding the nozzle opening 9a, the stem 18 under the action of the spring will be pressed against the pouring closure, so that a proper tolerance can be obtained through the spring travel. It is also not necessary to produce the stem 18 and the tube 5a in one piece, or, as shown in FIG. 2, to firmly lock them together. The stem 18 may be axially set in place in the pouring canal and preloaded by a spring, so that the simple act of the engagement of the free end of the tube 5a with the rear surface of the stem 18, will produce such an effect that the union shown in FIG. 2 by use of a screw thread or the like is rendered superfluous. In the same way, a stem 18, longer than that shown in FIG. 2, can be mounted in the pouring canal and be preloaded by means of a spring in the direction of opening of the pouring closure 19. By closing the pouring closure 19 through the forward sliding of the nozzle needle 3a, the tube 5a will press the stem 18 into the closing position. Also, close tolerances can be reduced if the tube 5a is made to slide into the nozzle needle 3a in the longitudinal direction and is kept in place and preloaded against a collar by a spring which is stronger than that of the stem 18. Finally, for the control of the stem 18 a special device may be installed so that it is possible to preload the stem 18 in its closing cycle and to retract it through special devices (by the use of a two arm reversing lever) when the mouthpiece is located in place. Through further coupling it is possible to retract the stem 18 along with the nozzle needle 3a.

The tube 5a, as well as the stem 18 can be supplied with a heating element, so that it contributes to the heating. Finally, the axial driving of the stem can be built as a heated torpedo or, where no pouring closure is supplied, such a torpedo be visualized in the mold.

It has been suggested in the previous discussion that the additional heating, i.e., the heating element 6a, heating elements from torpedoes, or the like, are connected permanently. It may be found to be advantageous to connect these heating elements during a given time before the stroke, during its operation, disconnected again at the end of the stroke, so that over-heating may be reduced without it being necessary to provide controlled connections. Equal temperatures, or spontaneous occurrence of heating, and a simplification of the control of the action of the heating can be obtained by constructing the heating element of the tube 5a, or of a stem, or of a torpedo not as electric resistors, but as electrodes or coils, so that they can be heated electrically through inductive or capacitive action.

In such case, it is possible to obtain not only spontaneous heating of the wall surfaces, but also heating of the mass of the synthetic material itself. Furthermore, it has also been found of value to construct the heating elements as heat exchangers, which through a heat exchanging medium will produce definite temperatures.

The effect to be accomplished by the invention may be also reached or strengthened by equipping the nozzle or mouthpiece with a cooling box or its equivalent. In all these cases it will be possible to arrive at comparatively lower cost methods by which the walls of the mold cavity come in contact only with synthetic material which is at least lower in foaming capacity then that of the material which fills the inner parts of the cavity, so that undesired textures in the wall areas are reduced.

It is obvious that minor changes may be made in the form and construction of the invention without departing from the material spirit thereof. It is not, however, desired to confine the invention to the exact form herein shown and described, but it is desired to include all such as properly come within the scope claimed.

The invention having been thus described, what is claimed as new and desired to secure by Letters Patent is:

1. Apparatus for injecting a plasticized material containing a foaming agent into a mold from an extruder, comprising:

a. a channel adapted to carry material from the extruder to the mold, the channel having an inner surface,

b. a nozzle in the channel, the nozzle having a nozzle opening which forms a portion of the channel,

c. a nozzle needle movable through the nozzle opening and having a frontal surface adapted to selectively close the nozzle opening,